SIRIUS XM
RADIO INC.

1500 Eckington Place, N.E.
Washington, D.C. 20002
Tel: 202-380-4000
Fax: 202-380-4500
www.sirius.com
www.xmradio.com

November 13, 2008

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Written *Ex Parte* Presentation
IB Docket No. 95-91
WT Docket No. 07-293

Dear Ms. Dortch:

Last week, Sirius XM Radio Inc. ("Sirius XM") met with the staff of the Office of Engineering and Technology ("OET") to discuss issues associated with the above-captioned proceedings, in which the Commission has proposed adopting final rules for satellite radio terrestrial repeater operation and changing Wireless Communications Services ("WCS") technical and operational requirements.[1] This letter provides supplemental information arising out of that meeting.

More specifically, Sirius XM provides greater detail on how it relies on signal diversity to deliver reliable and continuous service to its customers and how loss of even one of its diversity signal paths degrades that service. In addition, Sirius XM provides analysis of OET's recent technical report on Advanced Wireless Services ("AWS") interference. Sirius XM shows that if OET's methodology is applied to the WCS and satellite radio services, the results suggest technical standards on WCS mobile service that are fully consistent with Sirius XM's previously submitted recommendations. While the technical requirements Sirius XM proposes are more stringent than those proposed by WCS advocates, they would nonetheless further the Commission's goals of promoting broadband deployment by permitting mobile broadband in at least some portions of the WCS allocation while permitting fixed broadband service in the remaining portions of the WCS band.

---

[1] *See* Letter from Robert L. Pettit, Counsel to Sirius XM Radio, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 95-91, WT Docket No. 07-293, submitted Nov. 6, 2008 ("November 6 Ex Parte").

***The Mitigating Effect of Satellite Path Diversity*:** Figure 1 in the attached appendix shows the 2.3 GHz band plan for satellite radio service as well as the adjacent spectrum blocks that are allocated to WCS. This figure demonstrates that each of the two spectrum blocks allocated for satellite radio service (identified as Sirius and XM) has been divided into sub-blocks for the provision of terrestrial repeater coverage and for the provision of satellite coverage. During our most recent meeting with OET staff, Sirius XM was asked to explain the impact to satellite radio service if interference from a mobile WCS device were sufficiently strong to prevent reception of the satellite signals only in the SDARS spectrum immediately adjacent to the WCS block.[2]

Implicit in the staff's question is an assumption that the multiple satellite feeds of the Sirius network and the XM network are redundant and that loss of one feed would not necessarily degrade the service received by satellite radio subscribers. This is incorrect. This misconception was first raised in comments filed by the WCS Coalition that proposed an out-of-band emissions ("OOBE") mask for WCS mobile devices that would allow higher levels of OOBE interference at the WCS/satellite radio band edge and then require higher levels of attenuation deeper inside the satellite radio allocation.[3] Figure 2 of the attached appendix shows how a "stepped" OOBE mask could be applied to frequencies that comprise the satellite radio allocation.

All satellite feeds require interference protection to preserve satellite radio's high level of availability – a feature demanded by our nearly 19 million subscribers. When constructing its satellite systems, Sirius XM could have chosen to utilize its entire satellite radio spectrum to transmit content at three times the current capacity. Sirius XM instead chose to build a diversity transmission scheme within the licensees' limited spectrum to deliver the content from relatively weak satellite signals at the required quality of service levels demanded by consumers. As a result, the two satellite feeds used for the Sirius and XM platforms are for purposes of diversity, not redundancy. In other words, the separate feeds are not interchangeable but are instead used in complementary fashion specifically to overcome foliage, buildings, overpasses, nearby blocking vehicles and other obstacles to assure that the required service is provided to consumers. If the FCC allows significantly more interference through the use of a stepped OOBE mask to disrupt one of the two satellite feeds delivered by each of the two satellite radio platforms, there is a strong likelihood that service will be lost by substantial numbers of satellite radio subscribers.

Sirius XM's hybrid satellite/terrestrial design is based fundamentally on the use of satellite diversity to minimize the need for ground-based infrastructure in the form of terrestrial repeaters. The Sirius XM networks rely heavily on the systems' diversity

---

[2] For purposes of this discussion, it is assumed that there is no terrestrial repeater coverage to supplement the satellite signal, which is true for over 99 percent of the land area of the U.S. Moreover, as Sirius XM has shown, even in areas having repeater coverage, satellite radio receivers rely on the satellites to achieve adequate service reception quality. *See e.g.*, Letter from Patrick L. Donnelly and James S. Blitz to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 95-91, WT Docket No. 07-293, submitted July 9, 2008 at Appendix, page 11.

[3] *See*, Reply Comments of the WCS Coalition, IB Docket No. 95-91, WT Docket No. 07-293, March 17, 2008 at 10.

aspect to deliver high quality, continuous, broadcasts to low cost mobile receivers from distant satellites in order to avoid the need to build a large repeater network similar to the scope of terrestrial cellular communication systems. Spatial diversity is necessary to reduce outages due to a wide range of fading factors such as buildings, hills, trees. Signals from the two satellites located at up to 48,000 km away from the user location are transmitted in a frequency diversity scheme where each satellite transmits only certain frequencies allocated within the SDARS spectrum.

The impact of allowing interference to the outermost satellite feeds would be particularly disruptive to the XM platform. As shown in Figure 2, the two XM satellite sub-bands are further divided into two segments called "ensembles." In delivering service to subscribers, half of XM's audio and data content is transmitted using the upper two satellite carriers (*i.e.*, the "B" ensemble channels 1B and 2B) and the other half is transmitted in the lower two satellite carriers (*i.e.*, the "A" ensemble channels 1A and 2A). Allowing a stepped OOBE mask to disrupt the B ensemble channels would create an imbalance in service availability between the two halves of the bandwidth in the presence of a WCS mobile operating under these rules. In other words, the programming and data carried on the B ensemble channels would be lost to the subscriber and that lost data would not be available over the A ensemble channels.

The stepped mask concept is fundamentally flawed because it would treat similar satellite downlink sub-bands differently without adequate justification and would effectively prevent use of the two outer satellite downlink bands for consumer-quality satellite radio service, turning them into guard bands for WCS mobile service. Such an approach would be inconsistent with the FCC's allocation of the entire 2320-2345 MHz band to satellite radio[4] as well as its previous decision imposing stringent technical standards on WCS mobile use to avoid interference to satellite radio.[5] More importantly, it would significantly impair the ability of millions of customers to receive Sirius XM service. Throughout this proceeding, Sirius XM has recommended that any revisions to the WCS OOBE standards must ensure that the total out-of-band power received within the satellite receiver bandwidth remains below the level of impairment for any of the satellite signals. Sirius XM therefore recommends that the FCC not adopt rules for WCS service that anticipate degrading satellite radio reception.

***Analysis of AWS-3 Test Data*:** Sirius XM has reviewed the recent OET report on AWS-3 test data[6] and has applied the same methodology to develop OOBE and overload interference protection recommendations on WCS mobile devices. That analysis is shown in the attached appendix.

4 *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, 12 FCC Rcd 5754 (1997).

5 *Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service, Report and Order,* 12 FCC Rcd 10785, ¶¶ 136, 138 (1997).

6 *Advanced Wireless Service Interference Tests Results and Analysis*, Federal Communications Commission, Office of Engineering and Technology, WT Docket No. 07-195 (Oct. 10, 2008).

Essentially, Sirius XM follows the recently adopted OET methodology but uses path loss data and interference criteria that are applicable to the WCS and satellite radio services. Sirius XM summarizes the difference in its values with those used in the OET report and provides a brief explanation of why the other value was chosen.[7]

Importing that data into the equations provided by OET yields results that are fully consistent with Sirius XM's previous recommendations expressed throughout this proceeding. Sirius XM calculates that the OET methodology yields a required OOBE emissions mask of 86.5 + 10 log P (56 dBm/MHz) when appropriate path loss and interference criteria applicable to satellite radio are inserted into the relevant equations. Similarly, Sirius XM calculates maximum EIRP levels of 2 dBm/5 MHz for WCS mobile devices operating in the C and D blocks and 13 dBm/5 MHz for WCS mobile devices operating in the A and B blocks.[8]

Sirius XM believes that similar technical restrictions on WCS devices of this nature would allow for the introduction of WCS mobile broadband services on channel blocks that are not immediately adjacent to the satellite radio allocation (*i.e.*, in WCS spectrum blocks A and B) and would allow fixed broadband use compatible with satellite radio service on WCS blocks C and D. Sirius XM recommends that the FCC pursue such an approach to provide WCS licensees with greater flexibility than they had when they initially acquired their licenses while adequately protecting the only allocation of spectrum for satellite radio service.

* * * * *

Sirius XM appreciates the Commission's consideration of this data and urges the FCC to take all steps necessary to preserve high quality satellite radio service to nearly 19 million subscribers.

Respectfully Submitted,

<u>/s/ *Terrence R. Smith*</u>
Terrence R. Smith
Senior Vice President, Technology
Sirius XM Radio Inc.
1221 Avenue of the Americas
New York, NY 10020

<u>/s/ *James S. Blitz*</u>
James S. Blitz
Vice President, Regulatory Counsel
Sirius XM Radio Inc.
1500 Eckington Place, NE
Washington, DC 20002

---

[7] In this regard, Sirius XM notes that it included 3.5 dB of path loss for multipath effects as was done in the OET Report. However, Sirius XM is unable to confirm through independent sources that this is an appropriate allowance when the victim receiver and the interfering device are located within 3 meters of each other.

[8] It should be noted that the OET methodology does not consider situations where the victim receiver is subjected to interference from both OOBE and overload. Rather, the two interference mechanisms are treated separately, which is not likely in the real world. Therefore, additional interference protection should be provided to account for that likelihood.

Appendix

Sirius XM Radio, Inc.

IB Docket No. 95-91

WT Docket No. 07-293

November 13, 2008

Part 1:
Diversity Requirements of Satellite Radio

FIGURE 1
2.3 GHz Satellite Radio Band Plan

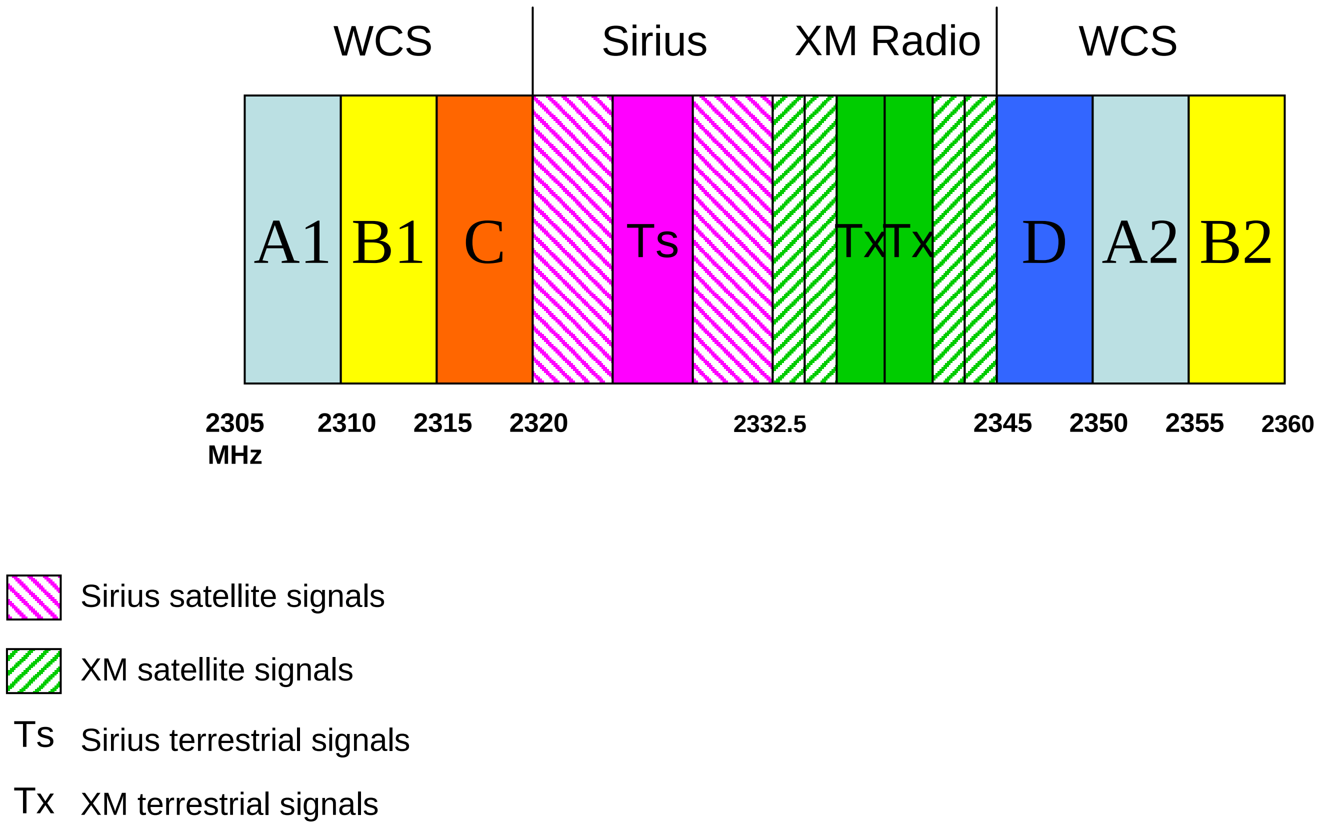

Figure 2
Stepped OOBE Noise Mask and XM's A & B Ensembles

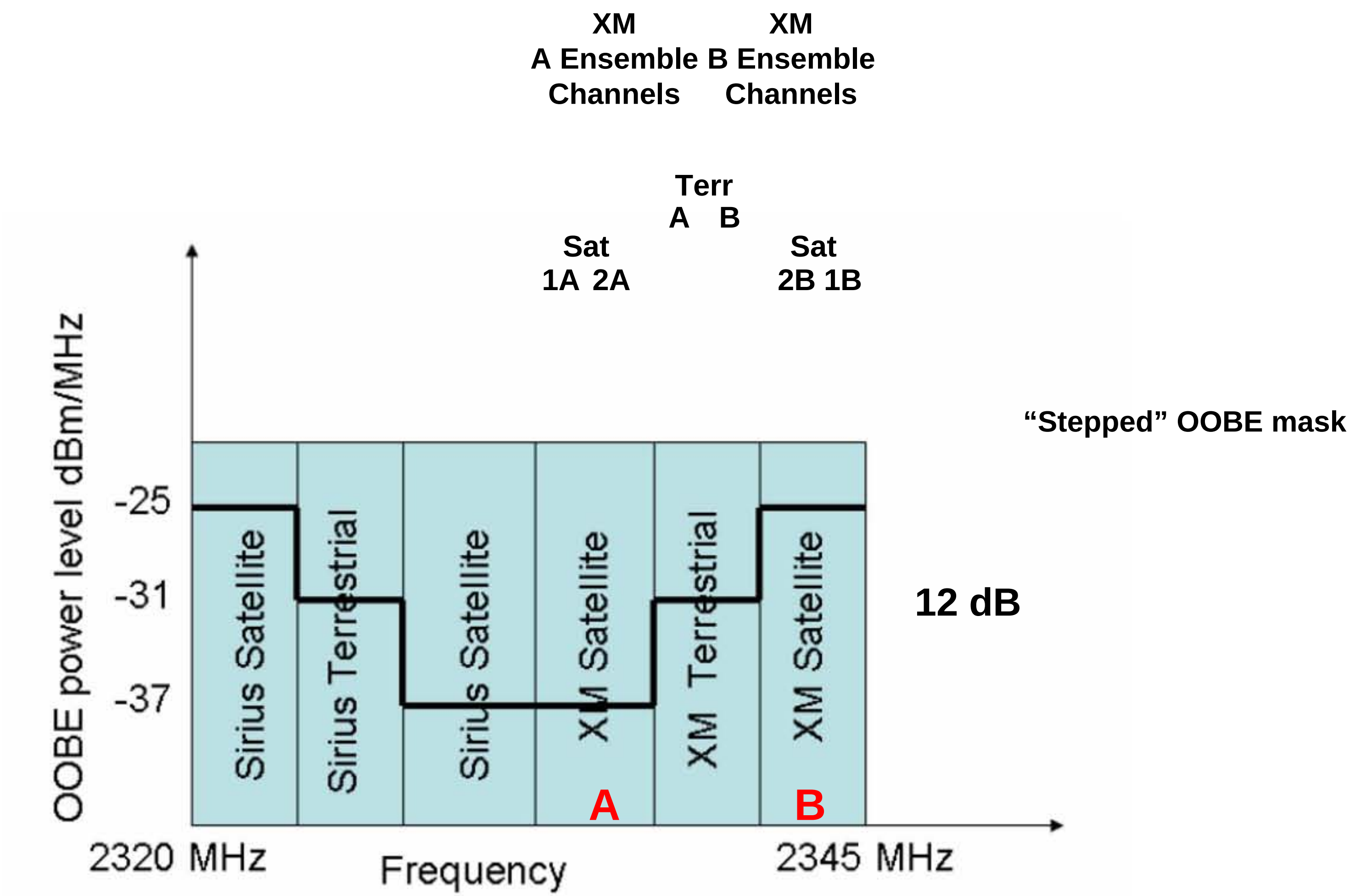

Figure 1. WCS Coalition proposed OOBE mask for mobile CPE

Part 2:
OOBE and Overload Interference Protection Requirements for Satellite Radio Using OET Methodology

Satellite Radio Parameters

OOBE (No overload)

- The received interfering power level (in band to SDARS) causing a 1 dB rise in the noise floor is -119 dBm/ 4MHz; for causing muting of satellite radio (served at the average serving signal level of -100 dBm) the interference power level is -107 dBm/ 4MHz

- These values were calculated as follows:
  - C/(I+N) required for decoding = ~6 dB
  - Combined (I+N) level to cause muting at -100 dBm serving level =-106 dBm/ 4MHz
  - Noise floor (N) =-113 dBm /4 MHz,
  - Interference (I)=-107 dBm/ 4MHz

- Source: Sirius XM Ex Parte, submitted Sept. 8, 2008

Satellite Radio Parameters

Overload (No OOBE)

- Received (out of band to SDARS) interfering power causing muting of satellite radio
  - A,B blocks = -44 dBm/5MHz
  - C,D blocks = -55 dBm/5MHz
- Source: Comments of Sirius Satellite Radio, Inc. IB Docket No. 95-91/WT Docket No. 07-293, submitted Feb. 15, 2008 at Exhibit C.

Path Loss and Coupling Loss Comparison

OET Analysis Parameter	OET Symbol	SDARS Equivalent Assumption	OET AWS-3 Assumption	Notes
Separation distance		3m	2m	Highway use case vs. pedestrian/mixed
Free Space Propagation Model Loss	FSL	49.24 dB at 2.317 GHz, 3m	45.12 dB at 2.1GHz, 2m	Same assumptions
Head-body loss	HBL	3 dB	6 dB	OET assumes body blockage on both ends of the link. Roof mounted SDARS antenna unlikely to have local blockage
Loss due to antenna mismatch of 2 dB	AM	1 dB	2 dB	Mismatch refers to two handsets held by users. For vehicle to vehicle they would be aligned
loss due to antenna efficiency		0 dB	0 dB	Same
AWS-1 OOBE slope of 3 dB	Lslope	0 dB	3 dB	This is specific to the test generator used in the AWS tests.
Multipath/Shadowing loss	MF	3.5 dB	3.5 dB	Sirius XM has been unable to verify this value.
Totals		56.74 dB	59.62 dB for OOBE 56.62 for Overload	

OET Analysis
OOBE

From OET October 10, 2008 Analysis

A. Required OOBE:

The following formula is used to determine the out-of-band emission levels of an AWS-3 handset that correspond to an interference event in an AWS-1 handset. All of the calculations shown in this section are based on the minimum desired received signal level of -95 dBm.

$OOBE = I_{OOBE} + \Sigma losses - BCF$, where

$\Sigma losses = FSL@_{2M} + HBL + AM + MF + Lslope$

- UMTS Interferer:

From Table 1, for the desired received signal level of -95 dBm, interference occurs when the interferer reaches a level of -83.2 dBm/5 MHz. Substituting this into the formula results in:

$OOBE_{AWS\text{-}3} = -83.2_{\ dBm/5\ MHz} + 45.12 + 6 + 2 + 3.5 + 3 - 10*\log(5) = -30.56_{\ dBm/MHz}$

This level of OOBE translates to a requirement for an AWS-3 handset to reduce its OOBE by about (60 + 10*log(P) dB) or more to avoid causing interference to AWS-1 handsets.

Satellite Radio Equivalent Using OET Analysis for OOBE

Required OOBE:

The following formula is used to determine the out-of-band emission levels of a WCS terminal that correspond to an interference event in a Satellite radio receiver. All of the calculations shown in this section are based on the minimum desired received signal level of -100 dBm.

OOBE = IOOBE + Σlosses - BCF, where

Σlosses = FSL@2M + HBL + AM + MF + Lslope

- WCS Interferer:

At the desired received signal level of -100 dBm, interference occurs when the interferer reaches a level of -107 dBm / 4MHz. Substituting this into the formula results in:

$OOBE_{WCS}$ = -107 /4MHz + 49.24 + 3 + 1 + 3.5 + 0 - 10*log(4) = -56.26 dBm/MHz

This level of OOBE translates to a requirement for a WCS terminal to reduce its OOBE by about (86 + 10*log(P) dB) or more to avoid causing interference to satellite radio receivers.

OET Analysis
Overload Interference

From OET Oct 10 2008 Analysis

B. Maximum Power of AWS-3 to prevent interference:

To calculate overload interference, we consider that the maximum overload interference (IOL) is related to the AWS-3 handset EIRP as follows:

$EIRP_{AWS\text{-}3}$ = IOL + Σlosses - BCF, where Σlosses = FSL_{2M} + HBL + AM + MF + FR[23]

a) UMTS desired vs. UMTS Interferer: Serving UMTS @ 2152.5 MHz and interferer UMTS at 2157 MHz

From table 2(a), desired signal level of -95 dBm corresponds to an I_{OL}= -28.2dBm.
Substituting this into the formula results in:

$EIRP_{AWS\text{-}3} = -28.2 + 45.12 + 6 + 2 + 3.5 - 10*\log(5) \approx 21.4$ dBm/MHz

b) UMTS desired vs. UMTS Interferer: Serving UMTS @ 2142.5 MHz and interferer UMTS at 2157 MHz

From table 2(b), desired signal level of -95 dBm corresponds to I_{OL} = -19.7 dBm.
Substituting this into the formula results in:

$EIRP_{AWS\text{-}3} = -19.7 + 45.12 + 6 + 2 + 3.5 - 10*\log(5) \approx 30$ dBm/MHz

Satellite Radio Equivalent Using OET Analysis for Overload

Maximum Power of WCS terminal to prevent interference:

To calculate overload interference, the maximum overload interference (IOL) is related to the WCS terminal EIRP as follows:

$$EIRP_{WCS} = IOL + \Sigma losses - BCF, \text{ where } \Sigma losses = FSL_{3M} + HBL + AM + MF$$

a) Satellite radio received signal vs. WCS Interferer: Satellite receiver @ 2322.2 MHz and WCS interferer at 2317.5 MHz (1st adjacent, C or D blocks)

At a desired signal level of -100 dBm corresponds to an IOL= -55 dBm.
Substituting this into the formula results in:

$EIRP_{WCS}$ = -55 + 49.24 + 3 + 1 + 3.5 + 0 - 10*log(5)) ≈ -5.26 $_{\text{dBm/MHz}}$ (1.74 $_{\text{dBm/ 5MHz}}$)

b) Satellite radio received signal vs. WCS Interferer: Satellite receiver @ 2322.2 MHz and WCS interferer at 2307.5 MHz (3rd adjacent, A or B blocks)

At a desired signal level of -100 dBm, this corresponds to IOL= -44 dBm.
Substituting this into the formula results in:

$EIRP_{WCS}$ = -44 + 49.24 + 3 + 1 + 3.5 + 0 - 10*log(5) =5.74 $_{\text{dBm/MHz}}$ (12.8 $_{\text{dBm/ 5MHz}}$)

Summary of Results

Criteria/Value	OET AWS-3 Proposal (Impairment to AWS-1 Receiver)	OET Methodology applied to WCS/SDARS (Impairment Criteria: Satellite Radio Receiver Muting)	Previously Filed Sirius XM Recommendations (Impairment Criteria: 1 dB rise in Noise Floor)
Excess Coupling Loss over Free Space	14.5 dB (mobile to mobile): OOBE 11.5 dB: Overload	7.5 dB	3 dB
OOBE Impairment Level (no overload)	-83.2 dBm/ 5MHz	-107 dBm/ 4MHz	-119 dBm/ 4MHz
Mobile OOBE Mask	60+10logP (1MHz) or -30 dBm/ MHz	86 +10 logP (1MHz) or -56 dBm/MHz	103+10logP (1MHz)
Overload Signal Level (no OOBE)	-28.2 dBm 1st Adjacent -20 dBm 2nd Adjacent	-55 dBm (C,D Block) -44 dBm (A,B block)	-55 dBm (C,D) -44 dBm (A,B)
Mobile Power Limit	21 dBm/ MHz Adjacent 30 dBm/MHz 2nd Adj.	+2 dBm/5 MHz [C,D] +13 dBm/5 MHz [A,B]	+0.1 dBm [C,D] +10 dBm [A,B]